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EFFICACY OF ADDING UREA ON SOME HERBICIDES EFFICIENCY IN CONTROLLING WEEDS ASSOCIATED IN MAIZE CROP

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ABSTRACT: **Two field experiments were performed during 2000 and 2001 summer seasons at the Agricultural Experimental Station of the National Research Centre at Shalakan, Kalubia Governorate, Egypt. The objective of the experiment was to study the effect of adding urea 1% to herbicide solution on weed control efficiency in maize crop. Weed control treatments were as follows: Bentazon, Fluroxypyr, Metosulam, Isoproturon, Bentazon + urea 1%, Fluroxypyr + urea 1%, Metosulam + urea 1%, Isoproturon + urea 1%, one hand hoeing, two hand hoeing and control.**

Results showed that all weed control treatments significantly depressed weed growth comparing to the unweeded one. Fluroxypyr treatment gave the best control of broad-leaved weeds in both seasons followed by that of two hand hoeing, Fluroxypyr mixed with urea and Metosulam mixed with urea treatments, respectively. Two hand hoeing was significantly the best control of grasses and total weeds in both seasons followed by that of Fluroxypyr and Fluroxypyr mixed with urea treatments, respectively.

All herbicidal treatments and two hand hoeing method markedly increased growth, yield and yield attributes as well as chemical composition of maize grains in both seasons. Maximum values of growth characters, yield and yield attributes were recorded from Fluroxypyr followed by two hand hoeing treatment, Fluroxypyr mixed with urea 1% and Metosulam mixed with urea 1%, respectively in both seasons. While, the highest values of plant height at harvest (cm) stem diameter (cm), protein and oil % were obtained by two hand hoeing followed by that of Fluroxypyr and Fluroxypyr mixed with urea 1% as well as Metosulam + urea 1%, respectively in both seasons.

INTRODUCTION

Increase grain yield of maize could be achieved by the development of high yielding varieties, better soil management and use of improved farm techniques. Weed control is one of the essential cultural practices for raising maize yield and improving its quality. The reduction in maize yield due to uncontrolled weed growth reached to 50% as calculated by El-Wekil *et al.* (1992). Effective weed control and high yield of maize were achieved by application of two hand hoeing (El-Bially, 1995; Hussein, 1997; Ahmed, 1999; Abd -El-Samie, 2000 and El-Metwally *et al.*, 2001), one hand hoeing (El-Wekil *et al.*, 1991); Bentazon (Saigusa *et al.*, 1993, Corkern *et al.*, 1999 and Wilcut *et al.*, 1999). Moshtohry *et al.* (1995) found that Fluroxypyr treatment gave the best control of broad-leaved weeds. Many other investigators came to the same conclusion (Schlotter and Schuster, 1992; Yehia *et al.*, 1992 and Roushdy, 1997).

However, the recommended dose of herbicide is relatively high and hence its cost price is too expensive under the Egyptian conditions. Recently, some evidence has been gathered that adding some additives especially the nitrogenous fertilizer to herbicide solution could increase its activity, consequently the dose of herbicide could be lowered and its cost price could be decreased. Moreover, lowering the dose of any herbicide is much appreciated from the point of view of minimizing pollution. In this respect, El-Desoki *et al.* (1993), Vizantinopoulos and Katranis (1998), Lesnik *et al.* (1999) and Metwally and Hassan (2001) reported that using some herbicides + urea or ammonium sulphate had higher efficiency in controlling annual weeds and increased yield and its components of wheat or maize as compared with other treatments used.

Therefore, the aim of the present work is to study the effect of some herbicides alone or in combination with urea on weed control efficiency in maize crop.

MATERIALS AND METHODS

Two field experiments were carried out during the two summer seasons of 2000 and 2001 at the Experimental Farm of National Research Centre at Shalakan, Kalubia Governorate, Egypt to study the influence of some herbicides applied alone or in combination with urea on

growth, yield and yield attributes of maize cv. Single cross Wattania 4 as well as associated weeds. The soil texture was clay loam with medium fertility, containing 1.78% organic matter and pH 7.8. A randomized complete blocks design with four replications was used in the two seasons. The normal cultural practices of growing maize plants were applied. Weed control treatments were as follows:

1. Bentazon (3-isopropyl 1H-2, 1, 3-benzathiadiazin – 4-(3H) one, 2, 2 –dioxide), known commercially as Basagran 48% E.C., sprayed after 3 weeks from sowing at the rate of 0.75 L/fed.
2. Fluroxypyr (4-Amino-3,5-Dichloro-6-fluoro-2-pyridloxy Acetic Acid), known commercially as Starane 20% E.C. sprayed 3 weeks from sowing at the rate of 0.200 L/fed.
3. Metosulam (N-2,6-dichloro-3-methyl phenyl)-5,7-dimethoxy-[1,2,4] Triazolo [1,5a] pyrimidine -2-sulphona mide), known commercially as Sinal 10 Sc sprayed 3 weeks from sowing at the rate of 0.030 L/fed.
4. Isoproturon (3-(4-Isoproyl phenyl)-1,1-dimethyl urea), known commercially as Arelon 50% sprayed 4 weeks from sowing at the rate of 1 L/fed.
5. Bentazon at the rate of 0.375 L/fed + urea 1%.
6. Fluroxypyr at the rate of 0.1 L/fed + urea 1%.
7. Metosulam at the rate of 0.015 L/fed + urea 1%.
8. Isoproturon at the rate of 0.5 L/fed + urea 1%.
9. One hand hoeing (before the first irrigation).
10. Two hand hoeing (before the first and the second irrigations).
11. Unweeded check (control) without hoeing or herbicide.

The herbicides were applied with knapsack sprayer equipped with one nozzle boom and water volume was 200 L/fed.

The experimental basic unit included 5 ridges, 70 cm apart and 3 m length, occupying an area of 10.5 m^2. The previous winter crop was wheat (*Triticum aestivum*, L.) in both seasons. Maize plants were sown on one side of the ridge in hills 30cm apart on 20th and 25th May in 2000 and 2001 seasons, respectively. Plants were thinned to one plant per hill (20000

plants/fed) before the first irrigation. Nitrogen in the form of urea (46 %N) was added in the two equal portions, after thinning and before the first and second irrigation (at a rate of 105 kg N/fed). Calcium superphosphate (15.5% P_2O_5) was applied during land preparation (at a rate of 150 kg/fed).

Studied characters:

1. Weeds:

Weeds were hand pulled from one square meter from each plot after 50 and 70 days from sowing and then were identified and classified into three groups i.e. broad-leaved, grasses and total weeds, fresh and dry weight of each group (g/m^2) were recorded. The common weeds in both growing seasons were *Amaranthus caudatus*, L.; *Echinochola colonum*, L.; *Portulaca oleraceae*, L.; *Corchorus olitorius*, L.; *Xanthium brasilicum*, L.; *Convolvulus arvensis*, L. and *Cynodon dactylon*, L.

2. Maize plants:

A. Plant growth:

In both seasons at 50 and 70 days from sowing, sample of five plants were taken randomly from each plot to determine plant height (cm), number of leaves/plant as well as fresh and dry weight of plant (g).

B. Yield and yield attributes:

At harvest, random samples of ten guarded plants were taken from each plot to estimate plant height (cm), stem diameter recorded at the internode below ear position, ear diameter (cm), ear length (cm), number of grains/row, ear grain weight (g), shelling percentage and 100-grain weight. Grain yield per feddan was estimated from the weight of grains/plot adjusted to 15% moisture.

C. Chemical composition of maize grains:

Total nitrogen content was estimated by the Kjeldahl method (Ranganna, 1979). N-values were multiplied by 6.25 to calculate protein content. Oil content was determined using the method described and used by Bedov (1970) using Soxhlet equipment.

Statistical analysis:

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) of A randomized Complete Blocks design and least significant difference (LSD) method was used to test the

differences between treatment means at 5% and 1% levels probability as published by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of different weed control treatments on:

A: Maize weeds:

The effect of different weed control treatments on fresh and dry weight of maize weeds after 50 and 70 days from sowing are presented in Tables 1 and 2. It is worthy, in the beginning, to notice that the effect of different weed control treatments under investigation on dry weight of maize weeds followed similar trends to those of fresh weight.

1. Broad – leaved weeds (g/m^2):

The results of weed control treatments presented in Tables 1 and 2 showed significant effects on fresh and dry weight of broad-leaved weeds after 50 and 70 days from sowing. Fluroxypyr cause a significant depression in the fresh and dry weight of broad-leaved weeds after 50 and 70 days from sowing followed by two hand hoeing, Fluroxypyr + urea, Metosulam + urea, and Metosulam alone, respectively in both seasons. On the contrary, the highest fresh and dry weight of broad-leaved weeds were recorded with the unweeded treatment. However, there were no significant differences in the fresh weight of broad leaved between two hand hoeing and Fluroxypyr + urea at 50 and 70 days from sowing in both seasons, respectively. Also, no significant differences between Isoproturon + urea, Metosulam or Bentazon after 50 and 70 days from sowing.

2. Grass weeds (g/m^2):

Relevant data showed that fresh and dry weight of grass weeds were markedly decreased by different weed control treatments (Tables 1 and 2). Two hand hoeing, Fluroxypyr, Fluroxypyr + urea and Metosulam + urea treatments were very effective in controlling most grass weeds at 50 and 70 days from sowing. On the other hand, the highest fresh and dry weight of grass weeds after 50 and 70 days from sowing were observed with unweeded treatment followed by that of Isoproturon, one hand hoeing and Bentazon treatments in both seasons as shown in Tables 1 and 2.

3. Total weeds (g/m^2):

In both seasons, the highest decrease in fresh and dry weight of total weeds after 50 and 70 days

Table 1: Fresh and dry weight of weeds (g/m^2) after 50 days from sowing as affected by weed control treatments during 2000 and 2001 growing seasons.

Characters / Treatments	Fresh weight at 50 days from sowing (g/m^2)						Dry weight at 50 days from sowing (g/m^2)					
	Broad leaved		Grasses		Total		Broad leaved		Grasses		Total	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Bentazon at 0.75 L/fed	195.00	215.00	1275.00	1300.00	1470.00	1515.00	39.00	43.00	212.50	216.67	251.50	259.67
Fluroxypyr at 0.2 L/fed	30.00	35.00	660.00	670.00	690.00	705.00	6.00	7.00	110.00	111.67	116.00	118.67
Metosulam at 0.3 L/fed	180.00	197.00	1245.00	1270.00	1425.00	1467.00	36.00	39.40	207.50	211.67	243.50	251.07
Isoproturon at 1 L/fed	255.00	280.00	1740.00	1770.00	1995.00	2050.00	51.00	56.00	290.40	295.00	341.40	351.00
Bentazon at 0.375 L/fed + urea 1%	150.00	162.00	1170.00	1190.00	1320.00	1352.00	30.00	32.40	195.20	198.34	225.20	230.74
Fluroxypyr at 0.1 L/fed + urea 1%	90.00	95.00	810.00	820.00	900.00	915.00	18.00	19.00	135.30	136.67	153.30	155.67
Metosulam at 0.15 L/fed + urea 1%	120.00	129.00	945.00	960.00	1065.00	1089.00	24.00	25.80	157.50	160.00	181.50	185.80
Isoproturon at 0.5 L/fed + urea 1%	180.00	195.00	1245.00	1265.00	1425.00	1460.00	36.00	39:00	207.50	210.84	243.50	249.84
One hand hoeing	225.00	247.00	1575.00	1600.00	1800.00	1847.00	45.00	49.40	262.50	266.67	307.50	316.07
Two hand hoeing	75.00	80.00	570.00	580.00	645.00	660.00	15.00	16.00	95.00	96.67	110.00	112.67
Control	1800.00	1850.00	2250.00	2300.00	4050.00	4150.00	360.00	370.00	375.00	383.34	735.00	753.34
F-test	**	**	**	**	**	**	**	**	**	**	**	**
LSD.5%	32.62	33.12	76.09	120.46	163.07	191.98	6.52	6.62	27.93	20.09	37.90	29.38
1%	43.49	44.16	101.45	160.61	217.41	255.96	8.70	8.83	37.24	26.78	50.53	39.17

Table 2: Fresh and dry weight of weeds (g/m^2) after 70 days from sowing as affected by weed control treatments during 2000 and 2001 growing seasons.

Characters / Treatments	Fresh weight at 70 days from sowing (g/m^2)						Dry weight at 70 days from sowing (g/m^2)					
	Broad-leaved		Grasses		Total		Broad-leaved		Grasses		Total	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Bentazon at 0.75 L/fed	253.50	279.50	1530.00	1560.00	1783.50	1839.50	50.70	55.90	255.00	260.00	305.70	315.90
Fluroxypyr at 0.2 L/fed	39.00	45.50	792.00	804.00	831.00	849.50	7.80	9.10	132.00	134.00	139.80	143.10
Metosulam at 0.3 L/fed	234.00	256.10	1494.00	1524.00	1728.00	1780.10	46.80	51.22	249.00	254.00	295.80	305.22
Isoproturon at 1 L/fed	331.50	364.00	2088.00	2124.00	2419.50	2488.00	66.30	72.80	348.00	354.00	414.30	426.80
Bentazon at 0.375 L/fed + urea 1%	195.00	210.60	1404.00	1428.00	1599.00	1638.60	39.00	42.12	234.00	238.00	273.00	280.12
Fluroxypyr at 0.1 L/fed + urea 1%	117.00	123.50	972.00	984.00	1089.00	1107.50	23.40	24.70	162.00	164.00	185.40	188.70
Metosulam at 0.15 L/fed + urea 1%	156.00	167.70	1134.00	1152.00	1290.00	1319.70	31.20	33.54	189.00	192.00	220.20	225.45
Isoproturon at 0.5 L/fed + urea 1%	230.00	253.50	1494.00	1518.00	1724.00	1771.50	46.00	50.70	249.00	253.00	295.00	203.70
One hand hoeing	295.00	321.10	1890.00	1920.00	2185.00	2241.10	59.00	64.22	315.00	320.00	374.00	384.20
Two hand hoeing	97.50	104.00	684.00	696.00	781.50	800.00	19.50	20.80	114.00	116.00	133.50	136.80
Control	2050.00	2405.00	2700.00	2760.00	4455.00	5165.00	410.00	481.00	450.00	460.00	860.00	941.00
F-test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	32.92	33.91	106.30	111.64	174.03	218.33	6.58	6.78	17.74	18.61	36.48	38.09
1%	43.89	45.21	141.73	148.86	278.43	291.05	8.78	9.04	23.65	24.81	48.65	50.78

from sowing were obtained by two hand hoeing followed by Fluroxypyr, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea treatments. The superior treatments decreased fresh weight of total weeds after 50 days from sowing than unweeded treatment by about 84.07, 82.96, 77.77, 73.7 and 67.41% in first season and by 84.10, 83.01, 77.95, 73.76 and 67.42% in the second season, respectively. Whereas, the superior treatments decreased the fresh weight of total weeds after 70 days from sowing than unweeded treatment by about 82.46, 81.35, 75.56, 71.04 and 64.11% in the first season and by 84.51, 83.55, 78.56, 74.45 and 68.27% in the second season, respectively. Vice-versa, unweeded treatment resulted the highest values of fresh and dry weight of total weeds in both 2000 and 2001 seasons.

Generally, results in Tables 1 and 2 revealed that all herbicide treatments used alone or mixed with urea and hand hoeing decreased statistically fresh and dry weight of broad leaved, grasses and total weeds grown with maize as compared with unweeded treatment. These results may be due to the inhibition effect of herbicidal treatments on growth of weeds. Two hand hoeing, Fluroxypyr, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea were the most effective for controlling of maize weeds. Also, Fluroxypyr, Metosulam and Bentazon as post-emergence herbicides produced a promising effect against weed prevailing in maize fields in comparison with unweeded treatment. The same conclusion was mentioned by El-Moursy and Badawi (1998), Rola and Golebiowska (1998), Rapparini *et al.* (2000), Roibu *et al.* (2000) and El-Metwally *et al.* (2001).

B. Growth of maize:

B.1. Plant height (cm):

Weed control methods significantly affected plant height at 50 and 70 days from sowing in the two seasons (Table 3). Fluroxypyr treatment recorded the highest values of plant height followed by that of two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea, respectively. On the other hand, the lowest plant height was recorded with the unweeded control. However, there were no significant differences among Fluroxypyr, two hand hoeing and Fluroxypyr + urea.

Table 3: Plant height (cm), number of leaves/plant as well as fresh and dry weight of maize plant (g) after 50 and 70 days from sowing as affected by weed control treatments during 2000 and 2001 seasons

Characters / Treatments	At 50 days from sowing								At 70 days from sowing							
	Plant height (cm)		Number of leaves/plant		Fresh weight of plant (g)		Dry weight of plant (g)		Plant height (cm)		Number of leaves/plant		Fresh weight of plant (g)		Dry weight of plant (g)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Bentazon at 0.75 L/fed	142.25	143.75	9.75	10.00	285.25	290.00	57.05	58.00	163.75	165.30	11.75	11.76	514.75	520.25	102.95	104.05
Fluroxypyr at 0.2 L/fed	163.00	166.00	12.00	12.25	430.00	420.50	86.00	84.10	214.00	220.50	13.00	13.01	684.25	694.25	136.85	138.85
Metosulam at 0.3 L/fed	146.00	147.50	9.75	10.00	295.00	300.00	59.00	60.00	168.75	170.00	11.50	11.75	526.00	540.75	105.20	108.15
Isoproturon at 1 L/fed	132.75	133.75	9.25	9.00	223.75	215.00	44.75	43.00	146.25	147.50	11.00	10.75	490.00	500.75	98.00	100.15
Bentazon at 0.375 L/fed+urea 1%	147.75	150.00	10.00	10.50	322.00	312.00	64.40	62.40	175.00	175.50	12.00	12.01	547.00	560.25	109.40	112.05
Fluroxypyr at 0.1 L/fed + urea 1%	156.25	159.25	11.00	11.75	370.00	360.00	74.00	72.00	198.25	200.75	12.25	12.75	616.50	625.40	123.30	125.08
Metosulam at 0.15 L/fed + urea 1%	151.75	154.00	10.75	11.00	341.00	331.60	68.20	66.32	175.50	180.00	12.25	12.26	570.75	600.00	114.15	120.00
Isoproturon at 0.5 L/fed + urea 1%	147.25	148.75	10.00	10.25	317.00	310.00	63.40	62.00	170.75	173.00	12.00	11.75	536.25	550.50	107.25	110.10
One hand hoeing	136.00	137.00	9.50	9.50	263.00	250.00	52.60	50.00	157.25	151.00	11.25	11.26	511.50	504.75	102.30	100.95
Two hand hoeing	160.25	163.25	11.00	12.00	425.00	410.00	85.00	82.00	208.25	215.75	12.75	13.00	619.75	630.50	123.95	126.10
Control	122.00	122.25	8.50	8.75	182.25	190.00	36.45	38.00	128.00	130.00	10.00	10.01	318.00	340.75	63.60	68.15
F-test	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	8.64	10.78	0.83	1.16	22.32	11.23	4.46	2.25	11.46	12.31	1.19	1.24	36.67	25.27	7.33	5.05
1%	11.52	14.37	1.11	1.55	29.76	14.97	5.95	2.99	15.28	16.41	1.58	1.65	48.90	33.69	9.78	6.74

B.2. Number of leaves/plant:

Data in Table 3 revealed that weed control treatments markedly increased number of leaves/plant after 50 and 70 days from sowing. Fluroxypyr and two hand hoeing gave the maximum numbers of leaves/plant followed by that of Fluroxypyr + urea, Metosulam + urea and Metosulam, respectively in both seasons. Vice-versa, the lowest number of leaves/plant was recorded with unweeded control.

B.3.Fresh and dry weight of plant (g):

Fresh and dry weight of plant appreciably influenced by weed control method in 2000 and 2001 seasons. The results in Table 3 show that all weed control treatments markedly increased fresh and dry weight of maize plant after 50 and 70 days from sowing as compared with the unweeded treatment. The best effect on fresh and dry weight of plant was markedly realized by foliar spraying with Fluroxypyr treatment followed by two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea, respectively. Whereas, the unweeded treatment gave the lowest fresh and dry weight of plant after 50 and 70 days from sowing.

Generally, it can be concluded that the highest increase in growth of maize plants were achieved from plots treated with Fluroxypyr, two hand hoeing, Fluroxypyr + urea and Metosulam + urea. The improvement effects of the studied weed treatments may be attributed to their effectiveness with maize plants for light, water, nutrients and space, thus enhancing plant growth. Same results were obtained by Rizk and El-Bially (1996), Ahmed (1999) and Abd El-Samie (2000).

C. Yield and yield attributes:

These studies include observation on plant height at harvest (cm), stem diameter (cm), ear diameter (cm), ear length (cm), number of grains/row, ear grain weight (g), shelling percentage, 100-grain weight (g) and grain yield (ardab/fed).

C.1. Plant height (cm):

Data in Table 4 revealed that weed control treatments significantly increased plant height at harvest in both seasons. Two hand hoeing, Fluroxypyr, Fluroxypyr + urea, Metosulam and Metosulam + urea produced the highest values of plant height in

both seasons as compared with that of unweeded treatment gave the lowest plant height.

C.2. Stem diameter (cm):

It is evident that stem diameter significantly affected by different weed control treatments in both seasons (Table 4). All herbicidal treatments and two hand hoeing produced higher stem diameter than unweeded plots. Application of two hand hoeing followed by Fluroxypyr and Fluroxypyr + urea increased stem diameter compared with the other treatments. In Contrast, the lowest stem diameter was recorded with unweeded treatment.

C.3. Ear diameter and length (cm):

The results reported in Table 4 showed that elimination of maize weed with different weed control treatments increased statistically ear diameter and length. The results clearly showed that Fluroxypyr, two hand hoeing, Fluroxypyr + urea and Metosulam + urea were the best treatments for increasing the ear diameter and length and exceeded other weed control treatments. However, there were no significant differences among Fluroxypyr, two hand hoeing, Fluroxypyr + urea and Metosulam + urea. In contrast, the lowest values of ear diameter and length were obtained by the unweeded treatment.

C.4. Numbers of grains/row:

The highest increase in number of grains/row was obtained with Fluroxypyr treatment followed by two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea. The increases amounted to 32.52, 30.67, 28.22, 23.31 and 22.09% in the first season and 22.41, 20.11, 18.97, 17.24 and 15.52 in the second season over the unweeded treatment, respectively as shown in Table 4. On the other hand, the lowest increase in number of grains/row over unweeded was recorded with Isoproturon treatment.

C.5. Ear grains weight (g):

The results presented in Table 5 show the effect of different weed control treatments on ear grain weight in both seasons. All herbicidal treatments and hand hoeing markedly produced higher ear grains weight than the unweeded plots. In both seasons, the highest increase in ear grains weight was obtained by Fluroxypyr treatment followed by that of two hand hoeing and

Fluroxypyr + urea treatments. In contrast, the lowest increase in ear grains weight over unweeded was recorded with Isoproturon treatment.

C.6. Shelling %

Weed control methods by using Fluroxypyr or two hand hoeing significantly affected the shelling % in the two seasons (Table 5). The maximum shelling % 82.06 and 82.13 in 2000 and 2001 seasons, respectively were achieved by using Fluroxypyr treatment followed by two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea, respectively in both seasons. The lowest shelling % 78.31 and 78.95 in the first and second seasons, respectively were obtained from the untreated (control).

C.7. 100-grain weight (g)

The results revealed that all weed control methods statistically increased 100-grain weight in both seasons (Table 5). The highest increase in 100-grain weight was obtained by Fluroxypyr treatment followed by that of two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea treatments without any significant differences between them. On the other hand, the lowest increase in 100-grain weight over the unweeded treatment was recorded with Isoproturon treatment.

It can be concluded that the highest increases in yield attributes of maize plants were achieved from plots treated with Fluroxypyr, two hand hoeing, Fluroxypyr + urea, Metosulam + urea and Bentazon + urea treatments, respectively. The superiority of these treatments in this respect contributed in controlling maize weeds and consequently improved yield components of maize. These results are in general agreement with those obtained by El-Gazzar *et al.* (1996), Hussein (1996), Mosalem and Shady (1996), Rizk and El-Bially (1996), Sharma *et al.* (1998) and El-Metwally *et al.* (2001).

C.8. Grain yield (ardab/fed)

Grain yield was significantly affected by different weed control methods in both seasons (Table 5). All herbicidal treatments and hand hoeing significantly produced higher grain yield than the unweeded plots. The highest increase in grain yield was obtained with Fluroxypyr treatment followed by two hand hoeing, Fluroxypyr + urea,

Metosulam, Metosulam + urea, Bentazon and Bentazon + urea, respectively. The increases amounted to 86.22, 81.32, 79.70, 72.56, 68.22, 66.98 and 63.25% in the first season and 89.94, 83.40, 79.87, 71.70, 71.07, 68.55 and 67.92% in the second season over the unweeded treatment, respectively. On the other hand, the lowest increase in grain yield over the unweeded was recorded with Isoproturon + urea treatment. However, there were no significant differences among Fluroxypyr, two hand hoeing and Fluroxypyr mixed with urea. The superiority of Fluroxypyr in producing high grain yield might be due to its high efficiency in controlling broad spectrum of weeds without damage to maize plants. This reduced the competitive effect of weeds and leading to the increase in grain yield. These results are in good accordance with those obtained by Moshtohry *et al.* (1995), Ahmed (1999), Wilcut *et al.* (1999), Krausz *et al.* (2000) and El-Metwally *et al.* (2001).

D. Chemical composition of maize grains:

D.1. Grains protein %:

These results revealed that all weed control treatments significantly increased protein percentage as shown in Table 5. The highest protein percentage was recorded with two hand hoeing treatment (9.47 and 9.44%) in the first and second seasons, respectively compared with other treatments followed by Fluroxypyr, Fluroxypyr + urea and Metosulam + urea. The lowest protein percentage was resulted from untreated plots (8.55 and 8.50%) in 2000 and 2001 seasons, respectively. Similar results were confirmed by Metwally *et al.* (1994). Ahmed (1999) and El-Metwally *et al.* (2001).

D.2. Grains oil percentage:

Data indicated that all weed control treatments increased markedly the oil percentage than the unweeded treatment (Table 5). The highest increase in oil % was obtained by two hand hoeing treatment followed by Fluroxypyr and Fluroxypyr mixed with urea treatments, respectively. These superior treatments increased the average of oil percentage than the unweeded treatment by about 12.56, 12.09 and 11.37% in the first season and 13.49, 13.25 and 12.53% in the second one, respectively. On the contrary, the lowest increase in oil% over the unweeded treatment was recorded with Isoproturon treatment. These

Table 5: Ear grains weight (g), shelling %, 100-grain weight (g), grain yield (ardab/fed), grains protein % and grains oil % as affected by weed control treatments during 2000 and 2001 seasons.

Characters / Treatments	Ear grains weight (g)		Shelling %		100-grain weight (g)		Grain yield (ardab/fed)		Grains protein %		Grains oil %	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Bentazon at 0.75 L/fed	191.30	190.50	80.59	80.98	40.49	40.70	27.10	27.20	8.99	8.94	4.55	4.50
Fluroxypyr at 0.2 L/fed	230.60	235.00	82.06	82.13	44.21	44.20	30.00	30.20	9.43	9.40	4.73	4.70
Metosulam at 0.3 L/fed	195.70	195.90	80.95	81.01	41.80	40.91	27.80	27.30	9.06	9.02	4.58	4.53
Isoproturon at 1 L/fed	179.80	180.80	79.91	80.00	40.02	39.80	25.5	25.80	8.85	8.80	4.48	4.41
Bentazon at 0.375 L/fed+urea 1%	203.50	208.31	81.37	81.56	43.60	41.32	26.30	26.70	9.17	9.13	4.63	4.58
Fluroxypyr at 0.1 L/fed + urea 1%	220.00	226.75	81.64	81.87	43.75	43.10	28.95	28.60	9.39	9.36	4.70	4.67
Metosulam at 0.15 L/fed + urea 1%	212.30	217.50	81.54	81.71	43.70	42.50	26.90	26.80	9.25	9.21	4.67	4.64
Isoproturon at 0.5 L/fed + urea 1%	201.75	202.50	81.14	81.04	42.35	41.23	24.60	25.00	9.12	9.08	4.61	4.56
One hand hoeing	186.50	188.30	80.50	80.17	40.14	40.66	24.90	24.60	8.95	8.90	4.50	4.42
Two hand hoeing	225.50	229.50	81.88	81.99	44.13	43.40	29.21	29.16	9.47	9.44	4.75	4.71
Control	123.80	120.90	78.31	78.95	29.60	30.80	16.11	15.90	8.55	8.50	4.22	4.15
F-test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	5.50	4.93	0.12	0.15	2.21	3.22	1.15	1.08	0.25	0.26	0.23	0.25
1%	7.33	6.57	0.17	0.20	2.95	4.29	1.53	1.44	0.34	0.35	0.30	0.33

findings are supported by Metwally *et al.* (1994), Ahmed (1999) and El-Metwally *et al.* (2001).

CONCLUSION

In general, two hand hoeing and application of herbicide treatments decreased significantly the fresh and dry weight of maize weeds in both seasons. Such results indicated that two hand hoeing and herbicidal treatments were efficient in increasing productivity of maize and the highest grain yield of maize can be obtained by two hand hoeing or choosing the most suitable herbicides (Fluroxypyr, Fluroxypyr mixed with urea, Metosulam mixed with urea and Bentazon mixed with urea).

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فعالية إضافة اليوريا على كفاءة بعض مبيدات الحشائش في مكافحة الحشائش المصاحبة لمحصول الذرة الشامية

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أقيمت تجربتان حقليتان خلال موسمى ٢٠٠٠ و ٢٠٠١ بمزرعة المركز القومى للبحوث بشلقان محافظة القليوبية بهدف دراسة تأثير إضافة اليوريا بتركيز ١% لمحلول مبيد الحشائش على كفاءة مكافحة الحشائش المصاحبة لمحصول الذرة وكانت المعاملات كالتالى: البنتازون ، الفلوروكسيبير ، الميتوسيولام ، الإيزوبروتون ، (نفس المبيدات + ١% يوريا) ، العزيق مرة ، العزيق مرتين ثم الكنترول وقد أظهرت النتائج كالتالى:

أظهرت معاملات مكافحة الحشائش نقصاً معنوياً فى الوزن الغض والجاف للحشائش المصاحبة لنبات الذرة بالمقارنة بالكنترول . وقد أعطى الفلوروكسيبير منفرداً أفضل مكافحة للحشائش العريضة تلاه العزيق مرتين ثم الفلوروكسيبير + ١% يوريا ثم الميتوسيولام + ١% يوريا فى كلا الموسمين ، بينما أعطى العزيق مرتين أفضل مكافحة للحشائش الضيقة والحشائش الكلية (ضيقة + عريضة) فى كلا الموسمين تلاه معاملة الفلوروكسيبير منفرداً ثم الفلوروكسيبير + ١% يوريا وعموماً لم يكن هناك فروق معنوية بين معاملة العزيق مرتين والفلوروكسيبير على كفاءة مكافحة الحشائش الكلية المصاحبة للذرة.

أدى استخدام معاملات مكافحة الحشائش إلى زيادة معنوية لصفات النمو والمحصول ومكوناته لنبات الذرة بالمقارنة بالكنترول ، حيث أدى إستخدام الفلوروكسيبير منفرداً تلاه العزيق مرتين إلى زيادة معنوية فى طول النبات وعدد الأوراق ووزن النباتات بعد ٥٠ و ٧٠ يوم من الزراعة كذلك زيادة معنوية فى طول وقطر الكوز ، عدد الحبوب بالصف ، وزن حبوب الكوز ، النسبة المئوية للتفريط ووزن ١٠٠ حبة بينما أعطى العزيق مرتين أفضل زيادة معنوية بالنسبة لطول اللنبات عند الحصاد وقطر الساق والنسبة المئوية للبروتين والزيت تلاه الفلوروكسيبير منفرداً ثم الفلوروكسيبير + ١% يوريا .

وعموماً لم يكن هناك فروق معنوية بين العزيق مرتين ومعاملة الفلوركسيبير منفرداً على جميع الصفات تحت الدراسة وكذلك بالنسبة الفلوروكسيبير منفرداً أو مخلوطاً مع ١% يوريا . لذلك يمكن التوصية بأنه للحصول على أفضل محصول من الذرة يمكن إستخدام الفلوروكسيبير منفرداً أو مخلوطاً مع ١% يوريا أو العزيق مرتين تحت ظروف منطقة البحث.